

**TRANSMISSION:** AW50-55SN/RESF22A/AF33-5 **FLUID QUANTITY**

**FLUID TYPE:** 1161540-8 / NissanMatic K /  
Type IV

Transmission: AW50-55SN 8 Qts  
Differential: Others 7.3 Qts.  
Including Diff.

**VALVE BODY BOLT TORQUE:** 85 INCH Lbs.

**NOTES:**

An early valve body has the SLS and SLT electrical connectors facing up. Later SLS and SLT solenoid connectors face down.

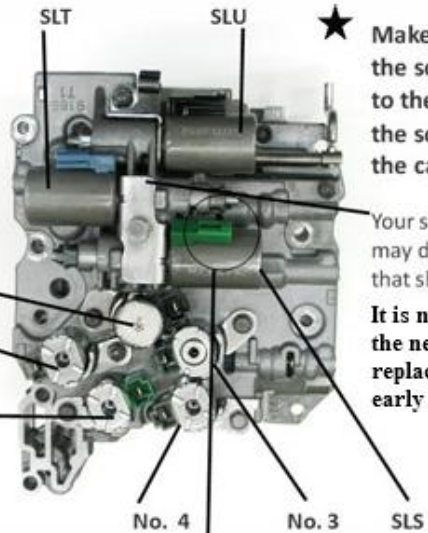
**PROTECH Tips:**

**No. 1**  
Reset the computer strategy

**No. 2**  
A bad servo, excess band travel or a bad B4 band can cause a 2-3 flare

**No. 3**  
To remove the solenoid electrical connector, use a small pick to lift the lock tab of the female side and slide the male part out.

**No. 4**  
**NOTE:** If the connectors are broken, the core value is lost.



★ **Make sure you match the solenoid bracket to the solenoids with the scribed marks on the casting**

Your solenoid bracket may differ slightly from that shown.

**It is necessary to use the new bracket to replace the old one in early and late models.**

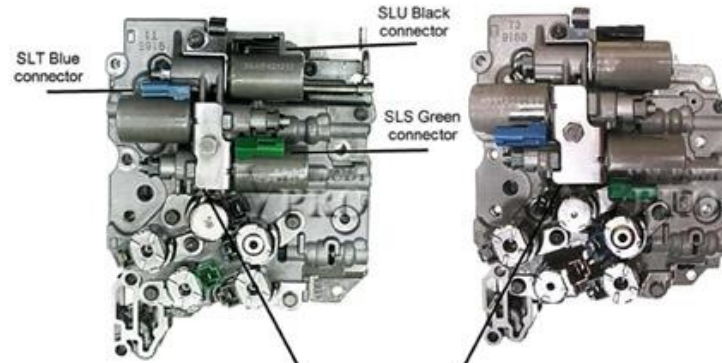


Make SURE connector tab clears the solenoid cap.

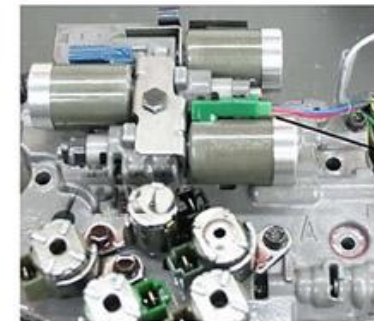
# AW55-50SN

**Early VB**

**Late VB**



This is the CORRECT way to install the bracket.



Make SURE connector tab clears the solenoid cap.

## AW 55-50 Differences Between Manufacturers

**In the United States, the AW 55-50 is used in the:**

- Saturn Ion and Vue, (AF23-5 in the 4 cylinder and AF33-5 in the V-6)
- Chevrolet Equinox and the Pontiac Torrent, (AF33-5)
- Nissan Altima, Maxima and Quest, (RE5F22A)
- Saab 9-3 and 9-5
- Volvo C70, S40, S60, S70, S80, S90, V40, V50, V70, XC70 and the XC90

As you can see, there are a lot of these transmissions on the street. It is important that you understand what a normal operating condition is and what is not normal for the vehicle that you are working on. Not all AW55-50 transmissions have the same operating features. As an example, Saturn has eight operating modes or shift strategies. They are normal mode, protection mode, cold mode, hot mode, uphill mode, downhill mode, high altitude mode and traffic jam mode. Each one of these modes has a different shift strategy. The customer is familiar with normal mode and may have noticed cold mode. The other modes don't show up very often and if noticed they may be seen as a very intermittent problem.

You may have a customer come in with a Saturn that has a complaint of 2nd gear starts or seems very sluggish with a lack of power from a start. The customer says that this only happens once in awhile. You could spend a lot of time trying to diagnose this normal condition, if you don't know that the computer is commanding the shifts in traffic jam mode.

Some Volvo models have a Neutral Control feature. This is when the computer turns off the C1 clutch when the vehicle comes to a complete stop for more than 2 seconds with the brake applied. This is a feature that the customer should never feel, but quite frequently you will get a harsh re-engagement and sometimes a downshift thud when the C1 clutch releases. Volvo has software updates to fix this as well as flare 2-3 shifts, harsh down shifts and harsh garage shifts. Most manufacturers have software upgrades for this transmission. Check with your local dealer for the latest upgrades available for your application.

As with almost all newer transmissions, the AW55-50 relies on adaptive strategy to adjust the shift feel for each shift. Whenever the transmission is overhauled or replaced, the valve body is replaced or the transmission control module (TCM) is replaced, the shift adapts must be cleared and relearned.

Failure to perform these procedures can result in shift feel and downshift clunk complaints, as well as reduced transmission life. Some vehicles relearn slowly and need to be relearned with a dealer equivalent scan tool. You don't want to damage your fresh overhaul waiting for the computer to relearn its adapts.

The challenge presented by having multiple manufacturers using the AW55-50 is that you need to be aware of the different operating modes and different relearn techniques. Understanding the operating system and procedures for each vehicle and knowing what bulletins and updates are available will go a long way toward fixing the car right the first time and keep you from wasting your time.

Next month we will cover the adaptives and their relearn procedures along with some known bulletins you should be aware of. For now, let's have a look at the variety of operating modes. As stated earlier, GM/Saturn strategy augments the normal operating mode with seven additional modes as outlined below.

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## GM/Saturn Shift Modes

**Protection Mode** – This mode is like failsafe or limp-in mode in other vehicles. When the protection mode is tripped by a code you will have 5th gear in drive and intermediate. When in manual low you will have 2nd gear. Cycling the ignition will give you normal mode again until the code is set again.

**Cold Mode** – When the engine coolant temperature is less than 122°F, the shifts will occur at a higher speed.

**Hot Mode** – When the transmission oil temperature reaches 284°F, the computer applies the converter clutch at lower than normal speeds and raises the shift points to a high speed. When the transmission oil temperature drops below 270°F, normal mode will resume.

**Downhill Mode** – When the throttle angle is less than 3% and the vehicle speed is increasing, the computer will command higher shift speeds to provide more engine braking.

**Uphill Mode** – When engine load is high and vehicle speed is decreasing, the computer will command higher shift speeds.

**High Altitude Mode** – When the barometric pressure is less than 12.76, the computer will command higher shift speeds.

**Traffic Jam Mode** – When the vehicle stops and starts with less than 10% throttle angle, the computer commands 2nd gear starts to increase fuel economy and reduce shift busyness. Normal mode resumes when the throttle angle is greater than 30% or vehicle speed is greater than 18.6 MPH.

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## Volvo Shift Modes

**Economy Mode** – This mode is used by TCM under normal acceleration. The TCM provides the earliest possible upshifts and lockup for best economy. The TCM adjusts oil pressure to provide smooth shifts and engagements.

**Sport Mode** – The TCM changes from economy to sport mode if the accelerator pedal is pressed down quickly and the vehicle exceeds 31MPH. In sports mode the shift points are raised to provide the best performance and down shifting occurs at lower engine RPM. When the accelerator pedal is moved less quickly, the TCM resumes economy mode automatically.

**Extreme Mode** – Extreme mode is another way of saying kick-down. The TCM selects the lowest possible gear, for the vehicle speed, when the throttle is depressed to the floor.

**Winter Mode** – Winter mode is selected by using the "W" button on the top panel of the gear selector assembly. A warning lamp in the instrument cluster illuminates when winter mode has been selected. When winter mode is activated, the transmission will start out in 3rd gear to provide maximum traction on slippery surfaces. Depending on manual gear selection, the following shift combinations can be obtained.

- D – The transaxle starts in 3rd gear, automatically shifting between 3rd, 4th, and 5th gears.
- 4 – The transaxle starts in 3rd gear and automatically shifts to 4th gear earlier than economy mode in D range. 5th gear is locked out.
- 3 – The transaxle starts in 3rd gear with no up shifts or down shifts.
- L – The transaxle starts in 2nd gear with no up shifts or down shifts.

At wide-open throttle in winter mode, the transaxle uses all gears for maximum performance.

**Catalytic Converter Start** – This function helps the engine to reach operating temperature by preventing converter lockup and delaying the 1-2 and 2-3 upshifts when the engine is cold. This is a normal function.

**Temperature Controlled Lock-up** – If the transmission temperature rises excessively as a result of a heavy load with high ambient temperature conditions, the torque converter clutch is applied to reduce heat generated by the torque converter. If the temperature drops below 20°C, (68°F), lock-up will be inhibited.

**Slipping Lock-up** – Slipping lock-up mode allows for a smoother lock-up engagement while reducing vibration and noise. The computer maintains a 50 to 200 RPM torque converter clutch slip in this mode. The following conditions must be met for this mode to activate:

- Gear shifter must be in the D, 4, or 3 position.
- Transmission must be in 3rd, 4th, or 5th gear.
- The transmission input speed must be 1100 RPM or higher and the throttle opening must be 35% or less.
- Engine coolant must reach a certain temperature.
- Transmission oil temperature must be at least 40°C (104°F), but not to exceed 120°C (248°F).

**Note:** The friction properties of this transmission fluid are different from other fluids due to the large amount of converter clutch slip. Failure to use the correct fluid will cause transmission damage and codes.

**Driving Uphill** – To reduce shift business, the TCM may change the shift pattern slightly when driving uphill.

**Neutral Control** – (This function is not available on all models). Neutral control is when the TCM disengages the forward clutch, (C1), at a stop with the brake applied. This reduces the load on the engine, therefore reducing engine vibration and improving fuel economy. When the brake is released the forward clutch engages. The following conditions must be met before the neutral control function will be allowed:

- Manual shifter must be in D, 4 or 3. Neutral control will not work in winter mode or when Geartronic is selected.
- Transmission oil temperature must be above 10°C or 50°F.
- Throttle position must be less than 3%.
- Brake pedal must be depressed.
- Vehicle speed must be zero MPH.
- Engine speed must be less than 1500 RPM.
- There is a 2 second delay once the vehicle has stopped in the D position and a 5 second delay when shifted from N to D.

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## Shifting Using Geartronic

When the shifter is moved to the Geartronic position, the transmission remains in the hydraulic "D" position. When the shifter is moved to the + or – positions, the gear selector module sends a signal to the TCM to shift the transmission up or down. The driver information module changes the symbol on the instrument cluster from D to the gear that has been selected. A signal is sent to the gear selector module to light the M and turn off the other LED's on the shifter console. The TCM determines if the shift can be carried out and activates the appropriate solenoids. The TCM will override the driver's command under certain circumstances. The following applies during Geartronic shifting:

- Only 1st, 2nd, or 3rd gears can be selected from a stop. The transmission will not up shift into 4th gear until a speed of at least 19MPH has been reached. The transmission will not up shift into 5th until a speed of at least 25MPH has been reached.

- Automatic down shifting occurs below certain speeds if driver forgets to manually down shift transmission. Manual up shifting is required after automatic down shifting has occurred.
- Kick-down is not available in Geartronic mode.
- The TCM will not allow the transmission to be manually down shifted if the engine speed would exceed 6000 RPM.
- If the transmission temperature gets too high, the TCM will select the correct gear so that lockup can be used.
- Torque converter lock-up is only possible in 3rd, 4th, and 5th.

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## Nissan Shift Modes

**Downslope Mode** – The TCM detects downhill driving when the vehicle speed increases with a closed throttle. During Downslope mode the TCM changes the shift points for more engine braking.

**Upslope Mode** – The TCM detects uphill driving when the engine load is high and the vehicle speed decreases. Upslope mode raises normal shift points to avoid busy shifting.

**Hot Mode Control** – When the transaxle temperature gets too high, (no specification is given by Nissan), the TCM changes the shift points to reduce the transaxle temperature.

**Manual Mode** – When the manual shift lever is moved to the manual shift position, the driver can manually up shift and down shift the transaxle. The TCM will automatically up shift the transaxle if the engine exceeds a specified RPM. The TCM will automatically down shift the transaxle if the vehicle speed falls below a specified value to avoid transaxle damage. The TCM will control converter clutch operation at all times.

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## Saab Shift Programs

**Manual Shifting Program** - Manual shifting can be accomplished by moving the manual shift lever to the "M" position. The driver can then control the up shifts and down shifts using the + and – buttons on the steering wheel. The TCM will override the manual controls if the engine RPM's get too high and the shift has not been commanded by the driver, or the driver forgets to down shift when the vehicle speed drops below the threshold for the selected gear. The TCM will not allow the driver to down shift the vehicle manually until the vehicle speed drops below a predetermined point for the particular gear. The driver can start from a stop in 1st, 2nd or 3rd only. The manual feature can even be used when cruise control is on.

**Temperature Program 1** - Temperature program 1 is activated when the transmission fluid temperature exceeds 125°C. Lock-up is activated in 3rd and 4th with no converter slip and the shifts are at a higher speed to cool the transmission fluid. When the transmission fluid temperature drops below 120°C the Temperature program 1 deactivates. Temperature program 1 will not activate when the TCM is in limp home.

**Temperature Program 2** - Temperature program 2 is activated when the transmission fluid temperature exceeds 135°C. This program forces the up shifts at an even higher speed and converter lock-up happens more often than in Temperature program 1. Lock-up is commanded on with no slippage during this program. Temperature program 2 will deactivate when the transmission fluid temperature drops below 127°C and returns to Temperature program 1. If the transmission fluid temperature rises above 155°C for more than 2 seconds, code P0218 is set, the temperature is recorded, the "CHECK GEARBOX" light does NOT light, and the TCM sends a Bus message of "TRANSMISSION OVERHEATING" which is shown in the PID display. Engine torque is reduced to a maximum of 200Nm to protect the transaxle.

**Special Gear Change Program** - A special gear change program is automatically activated if a high load is detected. The up shifts and down shifts will occur at a higher engine speed to keep the

transmission fluid from overheating. Examples of when this program would engage are: driving up long hills and trailer towing. The special gear change program will not initiate above 150 km/h.

**DPS Program** - Differential protection system or DPS reduces engine torque during extreme wheel spin. DPS will only activate below 80km/h. 150Nm is the maximum engine torque allowed during DPS activation.

**Reverse Inhibit Program** - There is a reverse inhibit feature that will turn on the S1 solenoid, which releases the B3 brake, if the TCM detects that the vehicle is moving at 7 km/h, (4.3 mph), or faster. Reading about all these modes makes it easy to see many possible intended or normal functions that could be mistaken for a functional problem. You will need to consider these modes carefully during your diagnosis, just as you will need to carefully work with relearn strategies when you complete a repair.

we explained the variety of operating modes the different manufacturers use to control AW 55-50 units in their vehicles. Knowing the modes and when they are activated is the first step in making an accurate diagnosis. A symptom reported by a customer may be normal, intended operation for one brand of vehicle and a legitimate problem in another. As part of your diagnosis, you should also be aware that every manufacturer has at least one transmission control module (TCM) reflash or replacement bulletin to address various transmission concerns.

If there is a problem and you complete a repair, the next challenge is to understand and correctly use the different relearn procedures. No matter which type of vehicle you are working on, it is imperative that the adaptive relearn procedures be performed to avoid shift feel and engagement feel problems.

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## **Volvo**

Performing the adaptive learn procedure on a Volvo requires a VADIS (Volvo factory scanner) to put the TCM in the "Control Module Adaptation" mode. Some vehicles do not have this function available and will need to have the TCM software reflashed so that the control module adaptation mode will work. The TCM will not go into adaptation mode unless the transmission oil temperature is between 150°F and 230°F. The TCM will not adapt in Geartronic or Winter Mode. While the TCM is in the Adaptation Mode, the orange triangle in the center of the instrument cluster will flash when the adaptation has been completed for a particular shift.

### **To Adapt the Up Shifts:**

- Use the "D" position. Accelerate from a stop at a light throttle, about 1400 rpm, through the gears to 4th, keeping the throttle steady. Come to a stop and repeat until the orange triangle flashes after each shift.
- Next, accelerate from a stop through all five gears at a throttle opening of about 1800 rpm, keeping the throttle steady. Come to a stop and repeat until the orange triangle flashes after each shift.
- Finally, accelerate through the gears at a throttle opening of 2500 rpm. Repeat until the orange triangle flashes after each shift.

### **To Adapt the Down Shifts:**

- Use "D" position. While driving at about 45 mph in 5th gear release the throttle and lightly brake to a stop. Repeat this procedure until the orange triangle flashes after each downshift.

### **To Adapt the Garage Shifts:**

- With the engine idling and the brake pedal depressed, shift to "N" and wait 5 seconds, now shift to "R", wait 5 seconds then shift to "N". Repeat this procedure until the orange triangle flashes.
- Repeat the above procedure for "D".



## To Adapt the Neutral Control Function:

*Note: Not every Volvo has the Neutral Control Function.*

- While driving at about 5 mph in "D", slowly come to a stop. Repeat this procedure until the orange triangle flashes.
- With the engine idling and the brake pedal depressed, move the shifter to "D" and wait about 25 seconds for the orange triangle to flash. This lets you know that the TCM is ready to adapt. Once the flash is seen, release the brake and allow the vehicle to crawl forward. Repeat this procedure until the orange triangle flashes just after the brake pedal is released.

Once all of the adapts have been learned, turn off the ignition and the TCM will exit the adaptation mode.

*For more precise information see Volvo Tech Bulletin # 43-27 for 2001 S60, V70, V70VC, and XC90 2.5T. For all other Volvos using the AW55-50 transmission, see Volvo Tech Bulletin # 43-20.*

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## Nissan

To clear the shift adapts, a Consult Scan Tool (Nissan factory scanner) must be used. The EEPROM in the TCM is erased and reset to the default settings during a process that Nissan refers to as "TCM Initialization". During this initialization the up shift, down shift, engagement, and torque reduction adapts are relearned.

At this time, no aftermarket scan tool is capable of performing the TCM Initialization, nor is there a manual reset procedure.

### Nissan Service Bulletin # NTB05-026

TCM Reprogramming Needed When Replacing A 5-Speed A/T. This bulletin applies to 2004-05 Maxima and 2005 Altima with 5- speed automatic transaxle.

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## GM/Saturn

### Resetting the Shift Adapts

The Chevrolet Equinox and the Pontiac Torrent require a scan tool to initiate the relearn procedure once the transmission oil temperature reaches 150°F. Clear the old shift adapts and initiate the relearn procedure with the Tech 2 or equivalent scan tool, then the adapts can be relearned as follows:

- **Neutral position adaptation** – follow the scan tool instructions.
- **N – D engagement adaptation** – Shift from neutral to drive, wait 3 seconds, and then shift back to neutral. Repeat 5 times.
- **N – R engagement adaptation** – Shift from neutral to reverse, wait 3 seconds, and then shift back to neutral. Repeat 5 times.
- **Up shift & down shift adaptation** – In the drive position, accelerate from a stop at a light throttle, about 15-20 % throttle angle, to 4th gear. Decelerate while braking lightly, using a minimum of 14 seconds to come to a full stop. Repeat 5 times. In the drive position, accelerate from a stop at a throttle opening of 50-55% all the way to 5th gear. Decelerate while braking lightly so that each down shift is felt. Repeat 5 times.
- **2-1 Down shift adaptation** – With the shifter in the intermediate range, accelerate above 16 mph, release the throttle, then manually shift to low range and come to a stop. Repeat 10 times.

The Tech 2 will work on Saturn vehicles too. There is a manual relearn procedure that can be used on the Saturn if a scan tool is not available. With the key off, "brain dead" the TCM by disconnecting both

battery cables, (remove the negative cable first), and connecting them together. Turn on the headlights and press on the brake pedal to drain the power from the TCM. If you turned the key on to drain the TCM, make sure that you turn the key off before reconnecting the battery. Reconnect the battery (positive 1st, negative last). By draining the power from the TCM, the adaptive learn is cleared to the default level.

Now you can perform the relearn procedures as shown above. It is always a good idea to check to see if the computer has the latest software upgrades. On GM vehicles this is made easy for the aftermarket technician. All you will need is the software calibration number, which can be retrieved by your scanner, and the vehicle VIN#. Go to the FREE GM calibration web site; plug in the VIN# of the vehicle you are working on and all of the software upgrades that are available for that vehicle will appear. Check to see if your calibration # is current. The web address is: <http://calid.gm.com>.

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## **Saab**

A Tech 2 or equivalent scan tool must be used to clear the shift adapts in the EEPROM of the TCM, (Saab refers to this procedure as zeroing the adapts). The EEPROM cannot be erased by disconnecting the power from the TCM. The Saab service information says that relearning the shift adapts can be accomplished with a 10-15 minute test drive under varying driving conditions, although they have a specific procedure set down for relearning the up shift, down shift, engagement, and manual down shift adapts.

### **Resetting the Adapts**

Using a Tech 2 or equivalent scan tool, zero out the shift adapts in the EEPROM. The transmission temperature must be 65–110°C for the TCM to relearn the adapts. DO NOT stall test the transaxle to warm it up!

### **Engagement Relearn Procedure**

- Set the parking brake.
- With the engine idling at operating temperature, shift from N to R.
- Keep in R for 3 seconds then shift back to N.
- Repeat 5 times then perform the same procedure for D.

### **Up Shift and Down Shift Relearn Procedure**

There is a shifting adaptation procedure in the factory manual for those instances where the normal drive does not produce satisfactory results. Always perform the engagement adaptation first, and then perform the shift adaptation procedure as follows:

- Put the manual shift lever in the D position and accelerate to just over 50 km/h at 15-20% throttle angle until the vehicle shifts into 4th gear. Next, slow the car to a stop with light brake pressure. It is important that it takes at least 30 seconds to get to 4th gear and more than 14 seconds to come to a stop.
- Repeat the above procedure 5 times.

### **Manual Shifting From 2nd to 1st Adaptation Relearn Procedure**

- Engage M2 with the shift lever.
- Accelerate to 25 km/h.
- Engage M1 and brake smoothly to a stop.



- Repeat procedure 10 times.

#### **Saab Service Bulletins for this Transaxle**

- TSB # 440-2425, January 2004. Springy up shift from 2nd to 3rd or 2-3 slide/slip. This bulletin involves reprogramming the TCM.
- TSB # 440-2498, October 2004. Hard, delayed or incorrect shifting, rising engine speed during shifting with various symptoms. Depending on the symptoms the fix could be sensors, software upgrades or internal transaxle repairs.

The AW 55-50 is everywhere and this unit will show up in your shop. As always, builders must learn the proper build techniques for the unit itself. The additional challenge for this unit is to pay careful attention to the specific program and control influences each manufacturer has applied.